

IONET Rate-Limiting Switch

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IPNOC / GSFC Code 291

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The Issue

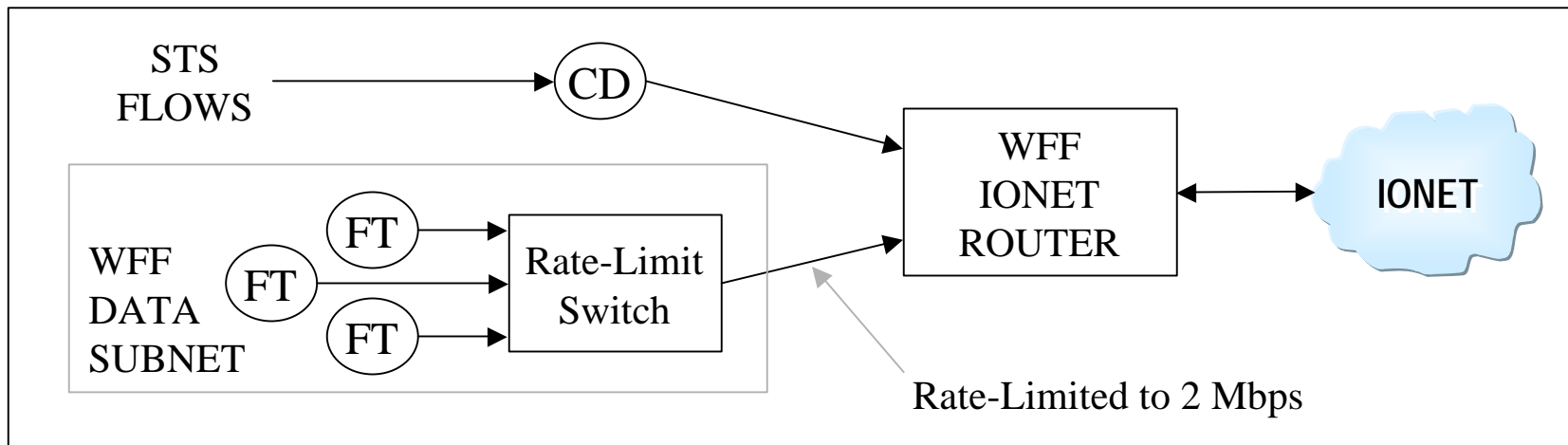
- Real-Time Mission Flows could be negatively impacted by File-Transfer (non-real-time) Flows
 - Real-Time Flows
 - Typically Multicast/UDP
 - Dropped blocks are not retransmitted → loss of data
 - Rate-limited by Spacecraft downlink rates (scheduled)
 - File-Transfer Flows
 - Typically TCP (e.g. FTP, Fastcopy)
 - Can ramp-up transfer rate to consume available bandwidth
 - Rate-limited by available bandwidth and/or system performance
- Primarily a problem for IONET sites which are shared with multiple projects or requirements

The Solution

- Rate-Limit the File-Transfer flows at IONET ingress to preserve *allocated* bandwidth for Real-Time flows
- Several other technical solutions were evaluated, Rate-Limiting was found best based on requirements and limitations (Operations, Management, Implementation, Requirements, and Technology Limitations)
- Current Rate-Limiting candidates
 - WGS (SAFS, LEO-T, etc.)
 - WSC (DAS, WDISC)
 - KSC (Hangar-AE, ELV & STS Payload)
 - JPL (CDR & OPS LAN)

Wallops Ground Station

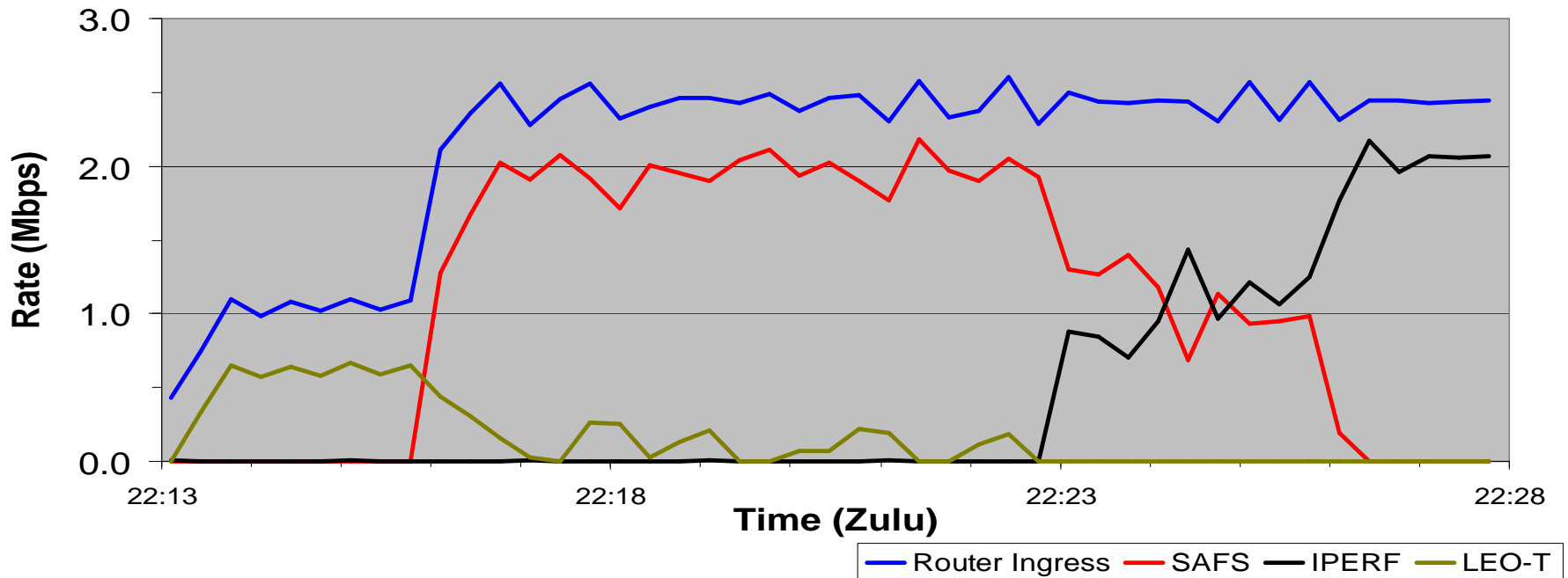
- Upcoming ADEOS-II mission has large File-Transfer demands at WGS
- WGS has several File-Transfer and Real-Time systems
- Rate-Limiting solution installed on WFF-Data Subnet and tested - July, 2002
 - File-Transfer flows on WFF-Data limited to 2 Mbps
 - No changes made to WGS STS support (CD subnets)



WGS Rate-Limit Testing

- Rate-Limit Implementation was thoroughly tested on 7/18 – 7/19/02
 - Test participants include: WGS, IPNOC, CDMGR, NOM, GC, DFE
 - STS 192k TM and 1024k dumps generated at WGS
 - STS flows closely monitored by DFE/JSC and CDMGR/GSFC for any impact
 - Network stressed by generating extended File-Transfer flows simultaneously by three hosts on WFF-Data subnet
- **No impact reported** to STS flows during several aggressive File-Transfer tests with Rate-Limiting solution
 - When Rate-Limiting was disabled, STS impact reported immediately

Sample WGS Test Results



- Network Statistics measured at Router and Rate-Limiting Switch
- Router Ingress measurement includes some non-rate-limited flows
- File-Transfer Rates throttled to 2 Mbps during all tests (no STS impact)
- No STS impact reported during file-transfer ramp-up

Recommendation

- Rate-Limiting solution can be installed on IONET interfaces as new requirements dictate
 - Sites with File-Transfer and Real-Time requirements
 - Sites with multiple projects or requirements
 - Sites which experience bandwidth contention issues

IONET Tail-Site Hardware Replacement

Nortel ASN Chassis

- Nortel ASN chassis is end-of-life, replacement required by Dec 31, 2002
- 19 ASN chassis identified to be replaced in IONET
- Existing ASN interface cards will work in ASN2 Replacement chassis
- No architecture or configuration changes required
- No site configuration changes (1-to-1 chassis swap-out)

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- Shuttle/ISS Sites
 - Dryden Flight Research Center
 - Onizuka Air Station
 - Wallops Ground Station
 - CSA
- Other Sites
 - CNES / Toulouse
 - Alaska Ground Station, Poker Flats
 - LSAT5, Lanham, MD
 - VAFB

Implementation

- Implementation to be scheduled with individual tail sites
- Implementation will be worked around Shuttle Missions, Critical Coverage Periods, and IONET Freezes
- IPNOC will coordinate dataflow acceptance tests with each site to verify proper operation

IONET Nortel Router

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Nortel Sof

- IONET Nortel Routers to be upgraded to Router Software Version 15.X
 - Upgrade from Version 12.0
 - Ver 12.0 deployed on IONET in May, 1999
 - Current Nortel RS is approaching end-of-life for support
 - Various Bug Fixes
 - New and updated features
 - No new features planned to be implemented until after successful upgrade

Lab Testing

- IPNOC will perform extensive acceptance testing in GSFC Code 290 Network Management Lab
 - Utilize IONET mock-up configuration replicating operational architecture
 - Simulate volume and quantity of IONET dataflows and routes to provide realistic test environment
 - Extensive monitoring of Multicast/UDP flows to verify no unexplained data drops
 - Exercise common failure-modes and stress conditions during testing
 - Estimate 2 months of testing

Implementation

- Target early CY 2003 for upgrade
- IONET Nortel Flash Memory to be upgraded (32MB flashes replace 16MB flashes) prior to Software Upgrade
 - Flashes procured by CSOC under NME
- Implementation Plans will be modeled after successful May, 1999 upgrade
 - Backbone to be upgraded in 2-3 phases, a few sites at a time (WSC, JSC, GSFC, KSC, MSFC, JPL)
 - Tail Sites will be upgraded one-at-a-time, based on site and IPNOC resource availability, and support requirements